NOAA SECTORAL APPLICATIONS RESEARCH PROGRAM (SARP)
PROJECT ANNUAL REPORT (DRAFT)

PROJECT TITLE
Urban Supply Reliability Under Climate Change: Policy, Economics and Water Management

INVESTIGATORS
(Research team and full contact information)

This project is conducted jointly by researchers at the University of Arizona and University of Colorado, namely:

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PROJECT YEARS We are in year 1 of a 2 year project (ending 7/31/09).

TIME PERIOD ADDRESSED BY REPORT *(e.g., August 2002-March 2003)*
August 2007 through April 2008.

I. PRELIMINARY MATERIALS

Water transfers are an increasingly important strategy used by cities in the West to augment water supplies and water supply reliability in an era of climate variability and change. Proposals to move water from the agricultural-to-urban sector (the most common type of transfer) are often highly controversial and protracted, in part because most transfers are permanent and are thus highly disruptive to the communities losing water. Permanent transfers can also be problematic for the purchasing city as well, especially when the goal of the purchase is to increase system reliability, a concern only in dry years. For both of these reasons, there is rapidly growing interest in, and experimentation with, more flexible and temporary forms of transfers that only move water in dry years. This allows farming regions to continue to farm in normal (or wet) years, while still providing cities with the water supply security they seek (at reduced cost). Additional benefits include a mechanism for compensating farmers for not farming in dry years

when water is transferred (and when farming would likely not be profitable anyway), limiting hydrologic disruptions (and associated environmental impacts), and limiting the need for cities to physically move and store transferred water to only those years when an established demand exists. Structuring transfer agreements in a way that is practical, legally enforceable, and economically efficient requires careful consideration and use of climate information. This project reviews the array of water transfers currently used in the West to improve urban supply reliability, identifies their advantages and disadvantages, and identifies the reforms necessary to increase their effectiveness as an adaptation mechanism to climate change and variability.

A Project Abstract *(Limit to one page)*

The proposed systematic identification and evaluation of new types of reliability-oriented transfer arrangements will produce significant benefits for many sectors and groups: e.g., cities, farmers, public agencies, corporations and environmental groups. Tools developed in this project will facilitate more effective use of climate information in planning for drought-induced shifts in urban supply and demand (particularly outdoor water demand) and for creating cost effective mitigation strategies for extended drought. Financial benefits will include enhanced supply reliability per dollar expended and reduced transfer-related conflict and litigation costs. To the extent that legal or policy rules impede the achievement of these goals, they will be identified and appropriate reforms proposed.

B Objective of Research Project *(Limit to one paragraph)*

The project brings together two threads of research: first, a largely economic investigation of water transfers, both traditional (permanent) and flexible, focusing on the relative social, economic, environmental and policy effects of the various arrangements; and second, a review of the legal and institutional frameworks in the western states governing what is, and is not, permitted in transfer arrangements. Throughout both threads of research, opportunities for integrating climate information into these transactions will be assessed.

The review of transfers will take advantage of a unique data set, recently created by Colby, encompassing thousands of western U.S. water transactions over a 30 year period. Assessment of transfer data will involve econometric modeling of relationships between price, quantity of water transferred and original uses (agriculture, municipal, etc.) and water supply conditions at the time of the transactions (comparing several indices, such as the Standard Precipitation Index and MEI (multivariate ENSO index)). For a selected set of a half-dozen urban areas, we will estimate the differences in economic costs of temporary transfers as compared to the traditional approach of acquiring more permanent water supplies than are necessary for average water supply years. To the extent practicable, community impacts and environmental consequences will also be considered. These in-depth case studies will be selected to represent a range of vulnerabilities to climate-induced supply risks and access to adaptation mechanisms.

The survey of western states' water laws will describe the current statutory and regulatory environment relating to water transfers, with a special focus on those provisions most salient in promoting or impeding flexible arrangements for achieving dry-year reliability. This review is also includes a focus on water transfer options for federal water projects and, additionally, the

special role of tribes, tribal water rights, and tribal water settlements in modifying the landscape of potential water transfer options. Given the magnitude of water distributed through federal projects and/or affiliated with tribal governments, this is a significant supplement to the review of state rules.

Water management stakeholders will be engaged in the research design process to identify the most relevant types of climate information and best strategies for delivering timely and applicable information to decision-makers. These stakeholders will also be a central focus of project products, including a guidebook outlining effective strategies for improving dry year supply reliability. For water-using sectors and the tax-paying public, the prospect of reduced conflict over water supply reliability and transfers offers significant cost saving along with improved working relationships and multi-sector cooperation to enhance regional supply reliability and risk sharing.

C **Approach (including methodological framework, models used, theory developed and tested, project monitoring and evaluation criteria) include a description of the key beneficiaries of the anticipated findings of this project (e.g., decision makers in a particular sector/level of government, researchers, private sector, science and resource management agencies)** ***(Limit to one page)***

D Description of any matching funds/activities used in this project ***(Limit to one paragraph)***

Both Lead PI Colby and Co-PI Kenney are associated with RISA programs (CLIMAS and WWA, respectively) from which expertise and, in some cases, services will be leveraged.

II. ACCOMPLISHMENTS

A. Brief discussion of project timeline and tasks accomplished. Include a discussion of data collected, models developed or augmented, fieldwork undertaken, or analysis and/or evaluation undertaken, workshops held, training or other capacity building activities implemented. ***(This can be submitted in bullet form – limit to two pages)***

The project is in the early stages, so accomplishments to date are limited.

University of Arizona researchers have been conducting a survey of types of voluntary transactions and exchanges designed to improve dry year reliability. While focused primarily in the US west, we also have identified promising examples in Australia and Spain. A draft report for internal team use is in preparation, for eventual dissemination. We are assembling a data base of water transactions for the period 1987-2007 that includes price, quantity, type of change in water use, location and details on the manner in which the transaction is structured. Once completed, this data will be an important source of information for the project.

At the University of Colorado, an initial review of state water transfer rules (with an emphasis on temporary transfers) has been completed 8 of the 11 westernmost states (excluding Alaska and Hawaii), based on information found in the relevant state statutes and cases. This information is currently being compiled into state summaries which are being reviewed by officials in state

government. Similarly, the review of federal water transfer regulations, including those related to tribal water rights, is also well underway. A draft summary of this material is expected by the end of August; at that time, a project web page will likely be established to facilitate additional project feedback.

Given that the project is being conducted at 2 universities, project leaders communicate periodically to assess work schedules, findings, and modifications.

B. Summary of findings, including their potential or actual implications for efforts to develop applications, methods, and science-based decision support capacity/systems and to foster sustainable resource management and vulnerability reduction. ***(Limit to two pages)***
The data base being assembled and the review of voluntary transactions shows a rich variety in the types of arrangements that have been used to improve dry year reliability. Research is ongoing to identify the strength and weaknesses of various ways of structuring transactions.

The review of laws shows that most western states have established very specific procedures in recent decades for conducting and evaluating water transfers, that most of these frameworks at least consider the possibility of temporary transfers, and a few are explicit in creating mechanisms for promoting flexible transfers through mechanisms such as water banks and leases. While many similarities can be found among the states, it is worth noting that every state has its own body of water law, so generalizations are difficult. This variability extends somewhat to federal projects and tribal rights, which are not all subject to the same legal frameworks. While one of the most sophisticated water markets in the West is associated with a federal project (the Colorado-Big Thompson project), ag-to-urban water transfers at most federal projects are often impractical given jurisdictional (and other) constraints. As a general rule, tribal rights cannot be easily marketed off-reservation, but again, significant variability exists, largely by the proliferation of case-specific tribal water right settlements that have become popular in recent decades. On all of these matters, additional research is needed (and is ongoing).

C. List of any reports, papers, publications or presentations arising from this project; please send any reprints of journal articles as they appear in the literature. Indicate whether a paper is formally reviewed and published. ***(No text limit)***
Given the early stages of the project, no publications are available.

D. Discussion of any significant deviations from proposed workplan (e.g., shift in priorities following consultation with program manager, delayed fieldwork due to late arrival of funds, obstacles encountered during the course of the project that have impacted outcome delivery). ***(Limit to one paragraph)***
The original design of the project called for funds to arrive and work to begin in the spring, whereas in practice, these things did not occur until the fall. Since, at both institutions, much of the work to be completed is scheduled for the summer months (given faculty schedules), this has meant a somewhat slow start to the project. This has also complicated the scheduling of student research related to the project. However, these are relatively minor issues. The next 6-months of

the project should be productive and critical, as efforts should increasingly involve field interviews.

E. Where appropriate, describe the climate information products and forecasts considered in your project (both NOAA and non-NOAA); identify any specific feedback on the NOAA products that might be helpful for improvement. (bulleted response)

The econometric modeling component of the study will take advantage of several climate and/or water indices, such as the Standard Precipitation Index and MEI (multivariate ENSO index).

III. GRAPHICS: PLEASE INCLUDE THE FOLLOWING GRAPHICS AS ATTACHMENTS TO YOUR REPORT

A. One Power point slide depicting the overall project framework/approach/results to date
B. If appropriate, additional graphic(s) or presentation(s) depicting any key research results thus far
C. Photographs (if easy to obtain) from fieldwork to depict study information (if applicable).

IV. WEBSITE ADDRESS FOR FURTHER INFORMATION (IF APPLICABLE)

A project website is not yet available.

V. ADDITIONAL RELEVANT INFORMATION NOT COVERED UNDER THE ABOVE CATEGORIES.